05276
SOV/170-59-7-7/20

18(4), 24(2)

AUTHORS: Kochanova, L.A., Andreyeva, I.A., Shchukin, Ye.D., Likhtman, V.I.

TITLE: Regularities in the Brittle Fracture of Pure and Alloyed Single Crystals of Zinc

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1959, Nr 7, pp 45 - 52 (USSR)

ABSTRACT: The authors studied regularities in the fracture of pure and alloyed single crystals of zinc in 3 kinds: containing 99.999% of elemental zinc, Pure crystals were taken along the cleavage plane (0001). Pure crystals containing 99.99% of it and commercial zinc; those of alloyed specimens contained 0.2 and 0.5% of cadmium. Experiments were carried out in two versions: in the absence of an active absorption medium at a temperature of -196°C and with a thin mercury film of about 5 μ thick applied to the specimen, at room temperature. Crystals were produced by the zonal crystalliza- tion method and were 0.5 to 0.9 mm in diameter and about 10 mm long. The fracture of crystals was performed on the Polyany device at a con- stant stretching rate of 10 to 15% per minute. The authors formulated a "condition of the constancy of the product of normal by shearing stresses", which is expressed by Formula 1: $P_c \cdot \tau_c = const = K^2$. By analyzing a ...erable amount of experimental data the authors have established that

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Regularities in the Brittle Fracture of Pure and Alloyed Single Crystals of Zinc

this condition is fulfilled within a wide range of orientations of
single crystals for both pure and alloyed specimens. As the quantity
of the admixture increases, the value of K also increases. The authors
explain this by a hypothesis on the origination of heterogeneities in
the shearing process and occurrence of plastic deformation during a
phase immediately preceding fracture. The value of K for amalgamated
specimens is twice as low compared to   . non-amalgamated
ones, both for pure and alloyed crystals. This is explained by the
lowering of the surface energy of zinc in the presence of mercury.
The condition formulated by the authors agrees well also with the ex-
perimental data of the other investigators in this field, such as
Deruyttere and Greenough /Ref 5/, and is consistent with the theory

Card 2/3   of P.A. Rebinder /Refs 7-10/ on the effect of adsorption-active media

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AUTHORS: Bryukhanova, L. S., Kochanova, L. A., Likhtman, V. I.   SOV/181-1-9-21/31

TITLE: . The Rules Governing the Brittle Destruction of Single Zinc
                Crystals

PERIODICAL:'   Fizika tverdogo tela, 1959, Vol 1, Nr 9, pp 1448 - 1456 (USSR)

ABSTRACT: The present paper offers a contribution to the problems
                related to modern technical requirements concerning the
                investigation of the relationship existing between the
                mechanical properties of metals and the chemicophysical
                influence exerted by the medium surrounding them during
                deformation. First, a number of pertinent papers is partly
                dealt with in detail, among others, publications by
                Academician P. A. Rebinder et al., Kishkin, Nikolenko, Ratner,
                Potaka, Shcheglakova, Rozhanskiy, Pertsov, and Shchukin. The
                authors of the present paper investigated the rules governing
                the brittle destruction of a single zinc crystal wire at
                different orientations of the base plane to the wire axis
                ($13° \leq \chi_0 \leq 80°$) at liquid nitrogen temperature ($-196°C$) at
                elongation at a constant rate ($\sim 12\%/min$). The single crystals

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The Rules Governing the Brittle Destruction of Single   SOV/181-1-9-21/31
Zinc Crystals

were pure to a degree of 99.99%, and were prepared in the authors' laboratory by zonal crystallization. The critical shearing stress in the base plane attained ~ 130 g/mm^2 at these temperatures and was independent of the orientation of this plane to the crystal axis, as shown by special experiments. Mercury was used as surface-active material. Figure 1 shows the measuring values and the calculated dependence of the limit of the plastic dislocation (a_m) of the single zinc crystals on the orientation angle of the base plane (χ_o). The steep decline of a_m is described by formula $a_m = \dfrac{(\varepsilon+1)\sin(\chi_o - \chi_1)}{\sin^2 \chi_o}$,

where ε is the limit of elongation before tearing, χ_1 is the final orientation of the base plane before tearing. Figure 2 shows the dependence of the normal tension N, acting upon the base plane, on the displacement a during deformation at different χ_o values. The following holds; $N = P \sin \chi_o \sin \chi_1$;

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The Rules Governing the Brittle Destruction of Single   SOV/181-1-9-21/31
Zinc Crystals

P is the indication of the dynamometer, proportional to the degree of elongation. Table 1 contains the values of a_m, N_m and S_m (shearing stress) for 6 χ_o values in the moment of brittle tearing. Figure 3 shows the dependence of the yield limit P and the critical normal tension N_o at the yield limit of χ_o at constant S, and figure 4 the dependence of a_m, N_m, and S_m on χ_o. $P_o(\chi_o)$ shows a symmetrical course, first a drop with growing χ_o, a minimum at $\sim 45^o$ and another rise; $S_o(\chi_o)$ rises exponentially with growing χ_o; $a_m(\chi_o)$ drops exponentially, $N_m(\chi_o)$ rises and $S_m(\chi_o)$ shows a linear drop with growing χ_o. Figure 5 shows the drop of N_m with rising pre-deformation (ε_{pre}) at 20^oC. (The samples were first elongated at room temperature, only thereafter cooled, and further elongated to the tearing point). All these experiments were also carried out under other conditions: the transition into the brittle state was not attained by cooling, but by the action of a strongly surface-active agent (Hg). Table 2

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18 (6)
AUTHORS:

Pertsov, N. V., Goryunov, Yu. V.,
Kochanova, L. A., Likhtman, V. I.

68783
S/170/59/002/12/013/02i
B014/B014

TITLE: The Influence Exerted by the Deformation Rate and Temperature Upon the Amount of the Adsorption Effect of Reduction in the Strength and Plasticity of Metals and Easily Fusible Metallic Melts

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1959, Vol 2, Nr 12, pp 77-82 (USSR)

ABSTRACT: In the experiments described amalgamated tin single crystals (purity of 99.999 %) about 1 mm thick were deformed at room temperature within a wide velocity range (from 10^2 to 10^6 % per minute). In order to study the effect of temperature, experiments were carried out in the temperature range $\pm$ 40° C and at - 196° C. The dependence of the elongation and actual breaking stress of amalgamated and non-amalgamated tin single crystals upon the logarithm of the reciprocal deformation rate is diagrammatically shown in figure 1. The diagram of figure 2 illustrates the elongation of pure and amalgamated tin crystals at 25° C and -196° C. Here the deformation rate was 15%/min. These and further experiments indicated that, if the rate of deformation is low, amalgamation does not affect the mechanical properties. It may be seen from figure 1

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The Influence Exerted by the Deformation Rate and
Temperature Upon the Amount of the Adsorption Effect
of Reduction in the Strength and Plasticity of Metals
and Easily Fusible Metallic Melts

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B014/B014

that at room temperature the action of mercury manifests itself
only at a rate of 10^4%/min. The dependence of the actual breaking
stress, elongation, and yield point of amalgamated and non-amal-
gamated tin single crystals upon temperature at a deformation rate
of 15%/min is graphically represented in figure 3. Below $-39°$ C it
is no more possible to observe an effect of mercury, which is ex-
plained by its solidification. It was further shown that the tem-
perature dependence of the above-described effects has the same
character as their dependence on the deformation rate. The part
played by surface-active mercury in these effects is explained by
the fact that it facilitates the further development of microcracks
into macroscopic cracks. There are 3 figures and 13 references, 12
of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR, g. Moskva (Institute of
Physical Chemistry of the AS USSR, City of Moscow)

Card 2/2

ABSTRACT: Study of plastic flow of lead and tin was carried out
                in two types of apparatus. The first apparatus, analogous
                to that of Andrade, is shown in Figure 1. It consists
                of a disc secured in the centre and at the periphery. A
                groove is cut between the centre and periphery so that
                there is a constant shear stress on all parts. It was
                shown that there was pure shear deformation developed in
                this groove. The second apparatus, suitable for working
                when surface-active media are present, is shown in
                Figure 2. Both types of apparatus gave the same results.
                Figure 3 shows the curves of flow of lead under constant
                stresses. Two distinct regions can be seen - a region
                with a decreasing and one with a steady rate of flow.
                The steady rate of flow (V_m) increases with increase in
Card1/3   stress and in the presence of a surface-active medium
                (0.2% oleic acid in vaseline oil). Analogous results were

The Plastic Flow of Lead and Tin Under Shear Conditions

obtained for tin. Figure 4 shows the relation between V_m and P (the applied stress) for lead and tin. The first parts of the curves are linear but only in a narrow range of low stresses. Marked flow begins at a definite stress P_o , termed the creep limit. P_o is 0.095 kg/mm^2 for lead and 0.09 kg/mm^2 for tin. The plastic viscosity for polycrystalline tin was calculated as 3×10^{14} poise (for a single crystal of tin, it is 3.2×10^{13} - Refs 6,7). There is great difficulty in measuring the initial rate of flow accurately. In the region of steady flow the viscosity can also be found. Figure 5 shows the relation between viscosity and stress for lead and tin. The most constant value is obtained in a narrow region near the creep limit. With increase in stress the coefficient of viscosity falls. Figure 6 shows the relation between plastic flow and stress on lead for

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The Plastic Flow of Lead and Tin Under Shear Conditions   SOV/126-8-2-18/26

relatively high stresses. At 0.7 kg/mm^2 there is a sharp rise in the curve. Figure 7 shows a similar relationship at $89\,^{\circ}$C. At this temperature, there is also strict proportionality between V_m and P in a narrow range of stresses up to the creep limit at 0.03 kg/mm^2 and the sharp rise in the curve occurs at a much lower stress than at room temperature.

There are 7 figures and 7 references, of which 5 are Soviet and 2 English.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR (Institute of Physical Chemistry of the Ac.Sc., USSR)

SUBMITTED: February 27, 1958

Card 3/3

SOV/126-8-2-19/26

AUTHORS: Kochanova, L.A., Likhtman, V.I. and Rebinder, P.A.

TITLE: Influence of Low Melting-point Fused Metal on the
              Mechanical Properties of Monocrystals of Higher Melting-
              point Metals

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 2,
              pp 288 - 293 (USSR)

ABSTRACT: Single crystals of zinc (99.99%) and cadmium (99.99%)
              were used in fused tin and lead. Samples were deformed
              at 10-15% per minute with a temperature constant to
              $\pm$ 5 $^{\circ}$C. The metallic medium (Sn or Pb) was deposited
              on the sample electrolytically (thickness 5 μ), which
              was then placed in a tube with powdered graphite to
              prevent oxidation, Figure 1 shows true stress-strain
              diagrams for pure zinc and zinc with a coating of tin.
              At room temperature the influence of tin is small but
              at higher temperatures tin causes a decrease in strength
              and plasticity. The relation between temperature and
              magnitude of the effect of tin is shown in Figure 2. The
              sharp increase in effect at 300 - 400 $^{\circ}$C is connected
              with an increase in solubility of zinc in tin. The

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Influence of Low Melting-point Fused Metal on the Mechanical
Properties of Monocrystals of Higher Melting-point Metals

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character of the fracture also changes from plastic in
air to brittle in tin. Lead-tin mixtures were also used.
The effect of pure lead is very slight but with increase
of tin content in the lead up to 20%, there is a sharp
decrease in strength and plasticity of zinc (Figure 3).
With further increase of tin content, the effect is much
slighter. It was shown that if zinc coated with tin is
held in lead at 400 °C for long priods, the strength of
the zinc recovers (Figure 4). This shows the absence of
any marked diffusion of tin in zinc. A decrease in
plasticity and strength of cadmium in tin was also found
(Figures 5,6). The results on single crystals show that
the decrease in strength is not connected with any grain-
boundary effect.

There are 6 figures and 21 references, of which 12 are
English and 9 Soviet.

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Influence of Low Melting-point Fused Metal on the Mechanical
Properties of Monocrystals of Higher Melting-point Metals

ASSOCIATION: Institut fizicheskoy khimii AN SSSR (Institute of
        Physical Chemistry of the Ac.Sc., USSR)

SUBMITTED: October 15, 1957

Card 3/3

24(2)

AUTHORS: Shchukin, Ye. D., Likhtman, V. L.

TITLE: On the Brittle Rupture in Single Crystals of Zinc
(O khrupkom razryve monokristallov tsinka)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 124, Nr 2, pp 307-310
(USSR)

ABSTRACT: If in a body there is a crack of the magnitude c, the relation
$p_c = \alpha \sqrt{E\sigma/c}$ holds for the dangerous tension vertical to the
surface of the crack; α here denotes a certain dimensional
coefficient which does not differ considerably from 1. Under
the action of the tension τ the crystal is assumed to be
shifted by the amount Δ, but shifting is not supposed to
propagate over the entire cross section because of the
presence of a sufficiently solid obstacle O in the slip plane.
Shear is then localized to a limited interval and the field of
tension existing in the region surrounding this defect can then
be compared with the elastic field of an incision which is
parallel to the applied tension. The maximum expanding tensions
act along a line forming the angle ⑭ with the plane of the
incision. An expression is written down for the reduction of

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On the Brittle Rupture in Single Crystals of Zinc   SOV/20-124-2-13/71

elastic energy as a result of the opening of the crack. If,
in the slip plane, shifts that have not been carried out
accumulate within the above interval, it may be that in the
crystal a crack corresponding to equilibrium is formed. The
author is interested in the limiting case of the largest possible
of such cracks. Such a case may arise if, before the afore-
mentioned "impenetrable obstacle", the interval, with high
concentration of the shifts not carried out, attains the
dimensions of the entire slip plane with respect to order of
magnitude. A formula is written down for the maximum amount of
tension. A quite similar result is obtained also on the basis
of the theory of dislocations. The relations written down in the
present paper are considerably simplified in the case of zinc
single crystals, because one and the same basis plane is at the
same time the only slip plane and the only distinctly marked
plane of cleavability. The crack will develop above all in that
direction of Ⓗ in which the local concentration of the
expanding tensions is greatest in a homogeneous isotropic medium.

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On the Brittle Rupture in Single Crystals of Zinc   SOV/20-124-2-13/71

In the case of zinc this angle Ⓗ will not be so large.
In conclusion, diagrams for the brittle rupture of
amalgamated zinc single crystals at room temperature are given
and discussed in short. There are 4 figures and 12 references,
6 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute for
Physical Chemistry of the Academy of Sciences, USSR)

PRESENTED: September 6, 1958, by P. A. Rebinder, Academician

SUBMITTED: June 7, 1958

Card 3/3

VAGRAMYAN, Ashot Tigranovich; PETROVA, Yuliya Stepanovna; LIKHTMAN, V.I.,
doktor fiziko-matem.nauk, otv.red.; ZHDANOV, S.I., red.izd-va;
ASTAF'YEVA, G.A., tekhn.red.

[Physicomechanical properties of electrolytic deposits] Fiziko-
mekhanicheskie svoistva elektroliticheskikh osadkov. Moskva,
Izd-vo Akad.nauk SSSR, 1960. 205 p.   (MIRA 13:11)
                  (Electroplating)

PHASE I BOOK EXPLOITATION   SOV/4575

Veyler, S. Ya., and V.I. Likhtman

Deystviye smazok pri obrabotke metallov davleniyem (The Role of Lubricants in the Pressworking of Metals) Moscow, Izd-vo AN SSSR, 1960. 231 p. Errata slip inserted. 4,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut fizicheskoy khimii.

Resp. Ed.: P.A. Rebinder, Academician.

PURPOSE: This book is intended for scientific and technical personnel. It may also be used by students of polytechnic and machine-building institutes.

COVERAGE: The book contains data on the compositions of lubricants used in the pressworking of metals. A large part of the book is devoted to the physico-chemical regularities of the lubricating process. In this connection the authors claim to have developed new ideas regarding the mechanism of the lubricating action. It is further stated that these new ideas have enabled the authors to describe quantitatively the processes of the drawing, deep drawing, and extrusion of metals and to develop physicochemical principles for the rational selection

Card 1/5

85202

S/074/60/029/010/003/004
B013/B075

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AUTHORS: Likhtman, V. I. and Shchukin, Ye. D.

TITLE: Surface Phenomena in Processes of Deformation and Destruction of Metals

PERIODICAL: Uspekhi khimii, 1960, Vol. 29, No. 10, pp. 1260-1284

TEXT: The subject of the present survey is the so-called Rebinder effect, in which small quantities of surface-active substances contained in the medium or in the body itself, play a part during the deformation and destruction of solid bodies. This effect is caused by a decrease of the free energy on new surfaces, which are formed during the deformation or destruction of solid bodies due to reversible (physical) adsorption. Adsorption essentially promotes the formation of these new surfaces and decreases the effort necessary for the deformation or destruction of bodies (Refs. 1-17). The authors point out that the adsorption-dependent change of mechanical properties of the bodies is by no means related to corrosion processes or to the dissolution of the body. The action of adsorption on the deformation- and stability properties of solids is of

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Surface Phenomena in Processes of Deformation   S/074/60/029/010/003/004
and Destruction of Metals   B013/B075

practical importance for metal working (Refs. 23, 26, 27), for powder production (Refs. 7, 8), etc. Investigation of these phenomena represents part of the new branch of science, the physico-chemical mechanics of solids. This field of research being developed by P. A. Rebinder and his collaborators has its origin at the boundary between molecular physics, solid-state physics, physical chemistry, and the mechanics of the contin- uous spectrum. The aim of this branch of science is the production of bodies with given structure and properties as well as the development of rational methods for the mechanical working of solid bodies by using physico-chemical factors (Refs. 6, 29). Monocrystals of metals are most suitable for investigation purposes. For these objects it is of special importance to apply the recent theory of dislocations to their present stage of development. By this means the possibility is also offered to analyze the mechanism of media acting on the deformation- and stability characteristics of bodies (Refs. 13-15, 19, 30). Some of these experiments are taken into special consideration: 1) Plastification of metal mono- crystals under the action or organic surface-active media (Refs. 3-5. 9, 10, 13, 14, 16, 19, 23, 24, 31-42). Experimental data confirm not only the adsorption character of this effect but show also the same rules as with the adsorption at liquid boundary surfaces. The plastifying effect

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Surface Phenomena in Processes of Deformation   S/074/60/029/010/003/004
and Destruction of Metals   B013/B075

which is extremely complicated and varied, is connected with a whole
spectrum of activation energies and can be observed in different tempera-
ture ranges as well as at different rates of deformation. 2) Decrease of
the free surface energy under the action of melting of more easily
meltable metals than the material concerned (Refs. 6, 11, 12, 14, 15, 17,
19, 21, 22, 24, 25, 29, 30, 43-60, 65, 66). The rules governing the
action of these highly surface-active media were studied in the Otdel
dispersnykh sistem Instituta fizicheskoy khimii AN SSSR (Department
for Disperse Systems of the Institute of Physical Chemistry AS USSR)
and at the kafedra kolloidnoy khimii MGU (Chair of Colloidal Chemistry
of Moscow State University). It was shown that under the effect of an
intensely absorptive medium a highly plastic monocrystal qualitatively
changes its mechanical properties and becomes brittle. Embrittlement de-
pends on temperature and rate of deformation. By comparing the investigat-
ed pairs metal - coating with binary meltability diagrams, a semi-empirical
rule could be set up, which indicates whether the metal concerned is, with
respect to another, more difficultly meltable one, intensely surface-active
or not. 3) Shift of the cold-brittleness limit in the presence of melted,
highly adsorptive coatings toward higher temperatures (Refs. 15, 19, 23,

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Surface Phenomena in Processes of Deformation   S/074/60/029/010/003/004
and Destruction of Metals   B013/B075

24, 42, 60). It can be assumed that the natural and the forced limit of
cold-brittleness have the same character. Its relative position on the
temperature scale depends only on the variability of the parameter σ.
4) Spontaneous dispersing, occurring at a considerable decrease of the
free surface energy of the solid body with its low effective solubility
in the respective medium (Refs. 13, 14, 24, 52, 62, 64). As Rebinder
has shown, dispersion takes place in colloidal particles δ_m of 10^{-6} cm,
i.e., of the order of magnitude of the structure-microunit. However, the
possibilities of this process are restricted by the equilibrium between
the colloidal particles and the substance being in the state of an effec-
tive solution, by the presence of a charge on the particle surface, as
well as by the micro-structure of the solid concerned. Table 1 contains
the maximum values of the plastifying effect and the corresponding
concentration of surface-active components for different organic surface-
active media. Table 2 contains the experimental values of K and of the
characteristic shift α_0, which corresponds to the fraction on curve $\tau(\alpha)$,
for zinc monocrystals of different purity degrees without coating (at a
temperature of liquid nitrogen) and with mercury coating (at room tempera-
ture) (Ref. 49). In Table 3 the rate of stabilized creeping of zinc mono-

Card 4/5

67563

SOV/20-130-2-17/69

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15 (5)

AUTHORS: Korbut, V. M., Veyler, S. Ya., Likhtman, V. I.

TITLE: The Importance of Adsorption Interactions and of the Mechanical Volume Properties of Lubricant Layers in Pressure Processing of Metals

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 130, Nr 2, pp 307 - 309 (USSR)

ABSTRACT: The authors studied the action of solid and liquid lubricant samples by a method earlier developed in their laboratory. This method is based on the separation of the total tangential stress into two parts in consequence of deformation: a) into the stress $P_m \Delta S$ needed for the volume deformation of the metal and b) into the stress needed for the elimination of friction - resistance τS_k to the shearing. The first component of the total deformation stress depends on the mechanical properties of the metal, and the second component depends on the mechanical properties of the surface layer in which friction takes place. $F = P_m \Delta S + \tau S_k$ holds for the total drag stress, where ΔS denotes

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The Importance of Adsorption Interactions and of the   SOV/20-130-2-17/69
Mechanical Volume Properties of Lubricant Layers in Pressure
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the reduction of the sample cross section in dragging, S_k the
contact surface between the instrument and the sample. Results
of the measurement of τ in various media in the dragging of
aluminum rods are listed in table 1. For aluminum, water in
solid state (-20°) has a better lubricity than in the liquid
state. Pure hydrocarbons - octane and dodecane at 20° - are in-
active lubricants and are squeezed out in dragging. Solidified
dodecane, however, has a good lubricity. Paraffin obtains its
optimum lubricity at 20°. The lubricity of paraffin is rapidly
reduced by melting. Alcohols are active lubricants at $+20^\circ$ and
-20° (i.e. in solid and liquid state). This does, however, not
apply to fatty acids the lubricity of which increases between
70 and 100° due to chemical interaction with the metal. At the
melting temperature, the lubricity of cetyl alcohol deterio-
rates, while those of stearic acid are slightly improved. On
solidification, resistance θ to the shift in the lubricant
volume increases and, consequently, also τ rises. In the absence
of chemical interaction τ and θ agree without being identical.

Card 2/3

S/020/60/133/01/19/070
B014/B011

AUTHORS: Kochanova, L. A., Shchukin, Ye. D., Likhtman, V. I.,
            Rebinder, P. A., Academician

TITLE: Origin and Development of Cracks in Deformed Crystals

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 133, No. 1,
            pp. 71-73

TEXT: By way of introduction, the authors subdivide the cracking of a
crystal on stretching into two stages depending on the course of deforma-
tion. In the stage A there occurs a slow formation and a gradual growth of
the cracks at sites with high tension; in the stage B the crack quickly ex-
tends over the entire cross section of the crystal. The authors discuss the
basic role of shear in stage A, and explain the origin of microcracks in
this stage by the unification of dislocations and the formation of hollow
nuclei. The mechanism of the development of cracks is closely examined, and
V. N. Rozhanskiy (Ref. 7) is mentioned in a discussion of the position of
the cracks in the lattice. The most probable arrangement is regarded to be
the serial arrangement of dislocations in a lattice plane, which develop to

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83131
S/020/60/133/005/008/019
B019/B054

/8. 8200

AUTHORS: Shchukin, Ye. D., Kochanova, L. A., Likhtman, V. I.

TITLE: Some Special Features of Brittle Destruction of Metallic Crystals

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 133, No. 5, pp. 1064 - 1066

TEXT: In the introduction, the authors refer to some of their own previous papers (Refs. 1 and 2). There, it had been clearly established that in the rupture of amalgamated single zinc crystals a spread of rupture stresses occurs along the basic plane (0001). If, for a given angle χ_0 between the plane (0001) and the sample axis, $P_{min}(\chi_0)$ and $P_{max}(\chi_0)$ are the minimum and maximum rupture stresses for the angle χ_0, then the relative quantity $(P_{max} - P_{min})/P_{max}$ strongly increases with increasing χ_0. For $\chi_0 > 50°$, this quantity remains below 10%, for $\chi_0 < 30°$, it attains a value of more than 25%. To clarify these relations, the

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B019/B054

Some Special Features of Brittle Destruction
of Metallic Crystals

authors carried out microscopic investigations of the basic planes (0001) of the fragments obtained in the rupture of many amalgamated single zinc crystals. The diameter of the single crystals L_0 was about 1 mm, χ_0 was between 20 and 70°. Many steps were found (Fig. 1) in the surfaces of fracture which were caused by cracks on the transition from one (0001) plane into the other. Thorough investigations showed that the main steps appear in the places of origin of rupture cracks. In previous papers (Refs. 3 and 4), the authors gave a detailed theory of the origin of cracks, and here they quote formula (1) obtained here:

$$(p_c \tau_c)_A^{1/2}/(p_c \tau_c)_B^{1/2} \equiv (P_c \sin^{3/2}\chi \cos^{1/2}\chi)_A/(P_c \sin^{3/2}\chi \cos^{1/2}\chi)_B = \sin^{1/2}\chi_0.$$

Here, P_c is the normal stress to the basic plane, τ_c is the shearing stress, the indices A and B refer to the type of fragment, and P_c is the break stress. Fig. 2 shows the experimental data, corresponding to (1), for six differently oriented samples. It appears that (1) is fulfilled in a wide range of orientation with an error of about 10%. From the results obtained, the authors infer the difference between the roles played by the

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83131

Some Special Features of Brittle Destruction of S/020/60/133/005/008/019
Metallic Crystals   B019/B054

outer and helical dislocations in the mechanism of destruction. By a
further investigation of normal and shearing stresses in the rupture of a
crystal it should be possible to solve a number of problems which are
connected with the temperature- and velocity dependence of destruction.
There are 2 figures and 11 references: 8 Soviet, 2 German, and 1 US.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute
              of Physical Chemistry of the Academy of Sciences, USSR)

PRESENTED: April 7, 1960, by P. A. Rebinder, Academician

SUBMITTED: March 29, 1960

Card 3/3

S/020/60/134/001/008/021
B019/B060

AUTHORS: Kosogov, G. F., Likhtman, V. I.

TITLE: Decrease of the Strength of Steels in Metallic Melts Due
               to Adsorption

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 134, No. 1,
               pp. 81 - 84

TEXT: The analyses described here were made on carbon steels
(0.05 - 1.10% C) after normalization of annealing. A coating with readily
melting metals (tin and lead) was applied to the sample surfaces.
Various methods of applying readily melting metals had been studied in
preliminary investigations, and the soldering technique was eventually
chosen by the authors. The metal layers applied were 0.10 to 0.05 mm
thick. The samples were submitted to static tensile tests, in the course
of which they were appropriately heated. Results regarding tin are
graphically illustrated in Fig. 2. The coating effect was established in
the temperature range of 250 - 500°C. It may be seen therefrom that the

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S/020/60/134/001/008/021
B019/B060

Decrease of the Strength of Steels in
Metallic Melts Due to Adsorption

maximum of strength and stretching reduction increases with increasing
carbon content and shifts toward higher temperatures. Similar results
were obtained for lead. No such effect was found for Armco iron. The
same effects arise, however, in the carbonization and nitration of Armco
iron. As has been already known from experiments made with single crystals,
these effects can be explained by the easier formation of microcracks
due to easily melting metals on the action of states of stress promoting
the formation of cracks. Such favorable states of stress are normal
stresses, and since in torsion tests they are considerably smaller than
in tensile tests, the strength and stretching reduction would have to be
likewise smaller in torsion tests. This was fully confirmed by
experiments. Medium-carbon steel, e.g., exhibits no reduction of the
values by adsorption effects in torsion tests made on zinc at 350°C
where the maximum reduction of strength and stretching was ascertained.
There are 2 figures, 2 tables, and 14 references: 10 Soviet and 4 US.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute
                of Physical Chemistry of the Academy of Sciences USSR)

Card 2/3

Decrease of the Strength of Steels in
Metallic Melts Due to Adsorption

S/020/60/134/001/008/021
B019/B060

PRESENTED: April 7, 1960, by P. A. Rebinder, Academician

SUBMITTED: March 28, 1960

Card 3/3

84833

S/020/60/134/005/021/023
B016/B054

18.6200   only 2308, 1437

AUTHORS: Likhtman, V. I., Gorbunov, N. S., Shatalova, I. G., and
            Rebinder, P. A., Academician

TITLE: On the Solidification by Vibration in Powder Metallurgy

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 134, No. 5,
            pp. 1150-1152

TEXT: The application of powder-metallurgical methods is much impeded by
the high pressures required for pressing, particularly if the powders are
highly disperse. Also the small amounts of surface-active lubricants
acting favorably to a certain degree and counteracting the relaxation of
elastic stresses (Ref. 1) are unable to encounter the cracking of pressed
pieces at high ram pressure. In their investigation, the authors proceeded
from the results of application of vibration to the production of
building materials (Ref. 2). They present the results of application of
vibration to the pressing of various powders used in powder metallurgy.
The vibration source used was a mechanical vibrator of the type VL-116
(I-116) with a frequency of 14,000 vibrations per minute, and a vibrational

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84833

On the Solidification by Vibration in
Powder Metallurgy

S/020/60/134/005/021/023
B016/B054

amplitude of 0.03 mm, which was found to be most favorable. Fig. 1 shows
a diagram of the vibrator mentioned (vibropress). Fig. 2 shows the time
dependence of the density of pressed pieces of powder mixtures as they
are used in hard-metal production. Hence, it appears that 10 seconds are
sufficient to attain maximum density. For various metal powders, and for
their mixtures with nonmetallic powders, optimum duration of vibropressing
lies between 4 and 10 sec. The dispersity of the powder, and particularly
its fractional composition, are of high importance. Coarse powders can be
better pressed than fine ones. Particularly good results were obtained in
vibropressing with a polydisperse powder containing both coarse and fine
particles within a wide range of sizes. The authors also studied the
pressure dependence of the density of pressed pieces in vibropressing.
The results were compared with those of ordinary static and hydrostatic
pressing. Figs. 3 and 4 give such data for mixtures of titanium- and
tungsten carbide with cobalt, which are used for the production of hard
metals of the types BK6 (VK6), BK20 (VK20), T15K6 (T15K6), and T30K4
(T30K4). For the first two types (with 6 and 20% by weight of Co,
respectively, rest: tungsten carbide), the ram pressure could be reduced
to about 1/100 with the application of vibration. Conditions were similar

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On the Solidification by Vibration in Powder Metallurgy	S/020/60/134/005/021/023 B016/B054

for other mixtures. By the methods described, it was possible to eliminate, to a great extent, the difficulties and defects of pressed pieces mentioned at the beginning. The authors thank N. V. Mikhaylov, Doctor of Technical Sciences, for assisting in the work. There are 4 figures and 2 Soviet references.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: June 8, 1960

Card 3/3

86051

158210   2109, 2209, 1436   S/020/60/135/003/037/039
B004/B060

AUTHORS: Smirnova, A. M., Pevzner, L. V., Raykova, T. V., and
Likhtman, V. I.

TITLE: Study of the Effect of Additions of Dispersed Iron as an
Active Filler on the Physicomechanical Properties of
Polymer Materials

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 135, No. 3,
pp. 663 - 666

TEXT: For their investigation, the authors proceed from studies made by
P. A. Rebinder at/al. (Refs. 1-3), according to which the introduction
of active fillers into polymers results in a strengthening of the spatial
network. These results are checked here by means of additions of iron
powder to polyamide resin -68, polyethylene and phenol-formaldehyde
resin (resol resin). The iron powder (specific surface 1.2 m^2/g) was
prepared in A. T. Vagramyan's laboratory. The specimens obtained after
introduction of Fe into the polymer solution were tested for strength

Card 1/3

86051

Study of the Effect of Additions of Dispersed   S/020/60/135/003/037/039
Iron as an Active Filler on the Physico-   B004/B060
mechanical Properties of Polymer Materials

and thermal stability. Fig.1 shows the effect of the Fe content on the
polymer strength. Different behaviors were observed, depending on the
nature of the polymers. The thermomechanical investigation showed for
resinol resin an increase of the vitrification temperature and a de-
crease of deformability with an increase of iron content. Pure resol
resin: 40% deformation at 150°C; resol resin with 80% Fe: 6% deforma-
tion at 300°C. In polyethylene, deformation as a function of tempera-
ture is hardly influenced by iron (at a content of up to 80% Fe). A
sudden change appears at 90% Fe. The 8% deformation occurring at 150°C
remains constant up to 400°C. It is believed that highly filled poly-
ethylene represents oriented films linked to the filler by adsorption-
chemical bonds. There are 4 figures and 8 Soviet references.

PRESENTED: June 18, 1960, by P. A. Rebinder, Academician

SUBMITTED: June 1, 1960
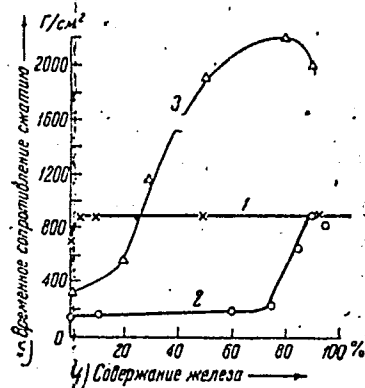

Card 2/3

Fig.1

8605!
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B004/B060

Legend to Fig.1:
Mechanical strength of polymers as a
function of the content of iron powder
as a filler. 1: polyamide resin-68,
2: polyethylene, 3: phenol-formalde-
hyde resin (resol resin), 4: iron con-
tent, 5: resistance to compression
(g/cm^2).

Card 3/3

18.9500

1521

32803
S/137/61/000/012/124/149
A006/A101

AUTHORS: Rebinder, P.A., Likhtman, V.I., Shchukin, Ye.D., Kochanova, L.A.,
Pertsov, N.V., Goryunov, Yu.V.

TITLE: Regularities and the mechanism of the effect of small surface ac-
tive admixtures on deformation and strength properties of single
crystal metals

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 12, 1961, 34-35, abstract
12Zh254 ("Tr. In-ta fiz. metallov, AN SSSR", 1960, no. 23, 147-161)

TEXT: Experiments were made with differently oriented Zn and Cd single
crystals of 1 mm in diameter, coated with a thin film of surface active Sn and
Hg metals. It is shown that at temperatures over T_s of "base metal-coating"
eutectics, the presence of a molten surface-active metal layer strongly reduces
deformability and strength of the specimen and promotes brittle failure. The
brittle effect of the surface active metal is mainly a function of temperature
and the deformation rate. Embrittlement and reduced strength are not connected
with corrosion processes but are caused by a decrease of the work which is
necessary for the development of crack nuclei, due to the adsorption of surface-

Card 1/2

Regularities and the mechanism ...

32803
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A006/A101

active metal atoms on the internal micro-surfaces. At a drop of the test temperature below T_s of the "base-metal-coating" eutectics, the embrittling effect vanishes gradually, due to a reduced mobility of adsorption-active atoms. The embrittling effect vanishes also at sufficiently high temperatures and low tension rates, when the resorption of deformation micro-heterogeneities and local stresses prevents the failure nuclei to develop into dangerous cracks, even at a considerable decrease of free surface energy. There are 21 references.

V. Stepanov

[Abstracter's note: Complete translation]

Card 2/2

39643
S/137/62/000/007/021/072
A052/A101

| .1600

AUTHORS: Gorbunov, N. S., Shatalova, I. G., Likhtman, V. I., Mikhaylov, N. V.,
            Rebinder, P. A.

TITLE: On the vibration method of compression in powder metallurgy

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 7, 1962, 47, abstract 7G325
             ("Poroshk. metallurgiya", no. 6, 1961, 10 - 16; English summary)

TEXT: The effect of working pressure on the change of density at a static
and vibration (vibrator with a vibration frequency of 14,000 per minute) pressing
of powders of Ti, Mo, SiC, B_4C, TiC and WC hard-alloy mixtures was studied. Vibra-
tion pressing is especially advantageous for unmoldable powders of refractory
compounds. When a vibrator is used the working pressure reduces approximately by
two orders of magnitude, which is connected with a better packing of powders. The
effect of the time factor and of the height of briquets on the change of density
was also studied.

                                                        R. Andriyevskiy

[Abstracter's note: Complete translation]

Card 1/1

20797

24.7500   1418,1136, 1143,2807   S/181/61/003/003/023/030
B102/B205

AUTHORS: Kochanova, L. A., Shchukin, Ye. D., and Likhtman, V. I.

TITLE: Mechanism of coarse destruction of metallic crystals

PERIODICAL: Fizika tverdogo tela, v. 3, no. 3, 1961, 902-910

TEXT: Studies conducted by the authors in their laboratory have shown that the mechanical properties of metals can be strongly influenced by placing them in highly adsorbing media (fusion of fusible metals). Such a treatment results in a considerable decrease in plasticity and strength. In the papers of Academician P. A. Rebinder et al. on the effect produced by adsorption from the ambient medium upon the mechanical properties of solids, these effects have been ascribed to the considerable decrease in free surface energy on the boundary between the deformed metal and its saturated solution in the other liquid metal. This effect of the metal melt occurs immediately. Experiments have shown that the rule governing the deformation and coarse destruction of metals is not altered by the presence of the liquid metal. The study of the mechanism of coarse destruction of metals is, however, considerably facilitated by the use of active metal melts. The present

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Mechanism of ...

20797
S/181/61/003/003/023/030
B102/B205

paper includes a detailed discussion of experimental data relating to this subject. The data were obtained at room temperature for amalgamated single crystals of zinc. Theoretical investigations have shown that the destruction (rupture on elongation) of single crystals of metals can be divided into two stages: <u>Stage A:</u> More or less slow formation and extension of "embryonic" cracks at points of elevated concentration of stresses, caused by inhomogeneities of plastic deformation. In this stage, the shear stress τ plays the most significant role. The growth of the cracks is accompanied by the occurrence of new dislocations. <u>Stage B:</u> Rapid extension of an unbalanced crack over the entire cross section of the crystal. This process is predominated by the normal stress p. The critical relation between normal stress and shear stress is given by $p_c \tau_c = \gamma^2 G\sigma/L$, where γ is a dimensionless coefficient which differs only slightly from 1; G is the shear modulus, L the cross section of the single crystal, and σ the specific free surface energy. Furthermore, the relations

$$c_{max} \sim \frac{\tau^2 L^2}{2E\sigma} = \frac{\beta\tau^2 L^2}{G\sigma} \quad (1) \text{ and } p_c = \alpha(E\sigma/c_{max})^{1/2} = \alpha'(G\sigma/c_{max})^{1/2} \quad (2) \text{ hold;}$$

c is the length of the crack, E the elastic modulus, and β a dimensionless Card 2/4

20797

Mechanism of ...

S/181/61/003/003/023/030
B102/B205

coefficient of the order of unity. The two last-mentioned relations which characterize A and B, respectively, were experimentally verified independently of each other. This was done by a study of the formation of cracks on an increase in p and τ. The specimens (amalgamated single crystals of zinc) had a purity of 99.99%, a diameter of 1 mm, a length of 10 mm, and showed different angles of inclination of the basal planes toward the axis of the specimens. The rate of elongation was constant and amounted to 12%/min. The stresses were determined from the relations

$\tau_c = P_0 \sin\chi_0 \cos\chi$, $P_c = P_0 \sin\chi_0 \sin\chi$, where P_0 is the tensile stress referred to the initial cross section, and χ is the angle of inclination of the basal plane toward the axis of the specimen for a given deformation ε. The validity of the function $c_{max}(\tau)$ was proved by a series of specimens with

$\chi_0 = 21°$, and specimens with χ_0 varying from 16 to 67° showed the correctness of the relation (2) by Griffith. A study of cracks of destroyed specimens has shown that the predominant role in the formation of destructive cracks is presumably played by angular or screw dislocations. V. N. Rozhanskiy is mentioned. There are 5 figures and 31 references: 21 Soviet-bloc and 10 non-Soviet-bloc.
Card 3/4

20797

S/181/61/003/003/023/030
B102/B205

Mechanism of ...

ASSOCIATION: Otdel dispersnykh sistem Instituta fizicheskoy khimii AN
SSSR Moskva (Department of Disperse Systems of the Institute
of Physical Chemistry of the AS USSR, Moscow)

SUBMITTED: July 28, 1960

Card 4/4

28094
S/181/61/003/009/028/039
B104/B102

18.8200   4016 1496 1413

AUTHORS: Bryukhanova, L. S., Andreyeva, I. A., and Likhtman, V. I.

TITLE: Rupture strength of metals and the effect of surface-active metal melts on it

PERIODICAL: Fizika tverdogo tela, v. 3, no. 9, 1961, 2774-2778

TEXT: The temperature and time dependences of the strength of amalgamated zinc and gallium-coated cadmium has been investigated. The wire samples were zinc crystals, polycrystalline zinc, and cadmium. Their diameter was 1 mm and their length 10 mm. A contact method was employed to coat the zinc samples with a thin Hg film (5 μ) in a mercury-nitrate solution. The cadmium samples were electrolytically coated with a gallium film. A relation between the lifetime and the angle χ between the basal plane and the sample axis was clearly established for differently oriented zinc single crystals. The values for logτ (τ denotes the lifetime in sec) for every χ and different loads are located on straight lines. According to S. N. Zhurkov, the activation energy U of the destruction is given by $U = U_\rho - \gamma P$, where γ denotes a structure factor and P the load. Test results furnish

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S/181/61/003/009/028/039
B104/B102

Rupture strength of metals and ...

U_o = 35 kcal/mole. This value agrees with those of other authors. Tests of zinc single crystals with $\chi \approx 50°$ at 20 and $50°C$ show that for different loads the time elapsing till the sample ruptures is considerably diminished by the Hg film (from several days to seconds). The same results have been obtained for amalgamated polycrystalline zinc and gallium-coated polycrystalline cadmium samples. It was found that the empirical relation

$$\tau = \tau_o \exp\left(\frac{U_o - \gamma P}{kT}\right)$$ cannot be used to estimate U_o and γ for Zn and Cd samples coated with Hg or Ga films. The effect of the films is not connected with a thermal activation but is the result of adsorption of surface-active atoms. The presence of surface-active substances will not affect the length of the destruction process as long as the normal component of stress is small. However, if this component reaches a value corresponding to the tensile strength of the metal, the surface cracks will grow rapidly and cause the sample to rupture. The rate of growth of these cracks is related to the rate of surface migration of the surface-active substance. It is not connected with any thermal activation of the destruction process. There are 6 figures and 10 references: 9 Soviet and 1 non-Soviet. The reference to English-language publications reads as

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28094

Rupture strength of metals and ...

S/181/61/003/009/028/039
B104/B102

follows: K. H. Mann et al., J. Phys. Chemistry, 64, 251, 1960.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR Moskva (Institute of Physical Chemistry, AS USSR, Moscow)

SUBMITTED: May 3, 1961

Card 3/3

18.8200 also 1327,2808

25711 S/020/61/139/002/011/017
B104/B205

AUTHORS: Likhtman, V. I., Bryukhanova, L. S., and Andreyeva, I. A.

TITLE: Long-time strength of metals

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 139, no. 2, 1961, 359 - 362

TEXT: The effect of surface-active metallic melts on the mechanical properties of high-melting metals has been studied in the authors' laboratory. It could be shown on single crystals of Zn, Cd, and Sn that the sudden loss in strength and plasticity occurring under the action of a thin film of a melt on a single crystal being stretched at a constant rate, is related neither with the grain boundaries, nor with the dissolution of the high-melting metal in the melt, nor with a chemical reaction between the metal and the basic metal, which leads to an intermetallic compound. The mechanism of this effect consists in a considerable adsorptive decrease of the surface energy of the high-melting metal (Rebinder effect) both on the external surface and on the two surfaces of the crack. S. N. Zhurkov et al. (ZhTF, 23, '677 (1953); DAN, 101, 237

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Long-time strength of metals

25781
S/020/61/139/002/011/017
B104/B205

(1955); Fiz. tverd. tela, 2, 1033 (1960)) have shown that the destruction of solids is a thermally activated process and, therefore, depends on the time of action of mechanical stress. Thus, it may be assumed that the dependence of the kinetics of the destruction of a metal on stress and temperature in the presence of an active melt makes it possible to estimate the role of thermal activation in this new mode of destruction. The authors studied single crystals of zinc of varying orientation, as well as zinc and cadmium polycrystals. The specimens were wires 1mm thick and 10 mm long. For zinc a thin Hg film was used as surface-active melt, and for cadmium a gallium film. The results obtained are illustrated in four graphs. On single crystals of zinc it was not possible to establish any relationship between the time elapsing until destruction and stress in the presence of a thin film. The single crystals broke suddenly at low stresses, and the transition from sudden rupture to practically infinite stability takes place within a very narrow range of stresses. Thus, it was not possible to find an intermediate value in this range. The same results were obtained for amalgamated zinc polycrystals and cadmium polycrystals coated with gallium. Amalgamated zinc specimens stretched at a constant rate are destroyed as soon as a stress of 1 kg/mm^2

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Long-time strength of metals

25781 S/020/61/139/002/011/017
B104/B205

is reached. This corresponds to the discontinuity on the curve $\log \tau$ = $f(P)$ which, in turn, corresponds to the transition from the destruction mechanism based on thermally activated processes to a mechanism based on an increase in the surface energy, which is brought about by the active melt. The second mechanism occurs not before a certain stress is attained. This corresponds to the braking strength of the metal which is reduced in the presence of the active melt. The authors thank Ye. D. Shchukin and L. A. Kochanova for discussions. There are 4 figures and 10 references: 9 Soviet-bloc and 1 non-Soviet-bloc. The reference to English-language publications reads as follows: K. H. Mann, et al. J. Phys. Chem., 64, 251 (1960).

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences USSR)

PRESENTED: March 15, 1961, by P. A. Rebinder, Academician

SUBMITTED: March 6, 1961

Card 3/4

29113
S/020/61/140/005/010/022
B125/B138

18 8200

AUTHORS: Chayevskiy, M. I., and Likhtman, V. I.

TITLE: Effect of the rate of deformation on strength and ductility
of carbon steel in contact with a fusible metal melt

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 140, no. 5, 1961, 1054-1057

TEXT: For a proper estimate of the effect of temperature and deformation
rate on the strength and plasticity of carbon steel, the problem must be
related to the critical transition range between brittleness and ductility.
If an increase in test temperature can fully eliminate the embrittling
effect of the melt on the steel, then it should be possible for the
critical temperature of the brittleness-to-plasticity transition to be
shifted toward higher or lower values by changing the rate of deformation.
This is confirmed by experiment. Fig. 1 shows the curves $\sigma = \sigma(\iota)$ for
samples of steel 20 at 400°C. At a deformation rate of 10 mm/min, the
melts have an embrittling effect on the steel; at 0.055 mm/min, however,
the ductility of the steel is restored or even increased. Similar
results are obtained in stress-rupture tests at quite low stresses. The

Card 1/4̶3

Effect of the rate of deformation on...

29114
S/020/61/140/005/010/022
B125/B138

ductility of the steel due to the melt under impact load shows that certain melts can be used to facilitate deformation in the die forging of steel. There are 4 figures and 7 Soviet references.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences USSR)

PRESENTED: April 18, 1961, by P. A. Rebinder, Academician

SUBMITTED: January 24, 1961

Fig. 1. Cruves $\sigma = \sigma(\varepsilon)$ obtained by testing steel 20 samples in the state described at 400°C. Legend: (1) Testing in air at $V = 10$ mm/min; (2) the same at $V = 0.055$ mm/min. (I) Testing of wetted samples in a melt of Pb-Sn eutectic at $V = 10$ mm/min; (II) the same in a melt of Pb-Bi eutectic at $V = 10$ mm/min; (III) the same in a melt of Pb-Sn eutectic at $V = 0.055$ mm/min; (IV) the same in a melt of Pb-Bi eutectic at $V = 0.055$ mm/min.

Card 3/4₃

LIKHTMAN, Vladimir Iosifovich; FAYNBOYM, I.B., red.; RAKITIN, I.T.,
tekhn. red.

[Life and death of metals] Zhizn' i smert' metallov. Moskva,
Izd-vo "Znanie," 1962. 31 p. (Novoe v zhizni, nauke, tekhnike.
IX Seriia: Fizika i khimiia, no.5)   (MIRA 15:5)
                              (Metals)

PHASE I BOOK EXPLOITATION   SOV/6247

Likhtman, Vladimir Iosifovich, Yevgeniy Dmitriyevich Shchukin, and
    Petr Aleksandrovich Rebinder

Fiziko-khimicheskaya mekhanika metallov; adsorbtsionnyye yavleniya
    v protsessakh deformatsii i razrusheniya metallov (Physicochemi-
    cal Mechanics of Metals; Adsorption Phenomena in Processes of
    Metal Deformation and Fracture). Moscow, Izd-vo AN SSSR, 1962.!
    302 p. Errata slip inserted. 7000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut fizicheskoy
    khimii.

Resp. Ed.: P. A. Rebinder, Academician; Ed.: N. G. Yegorov; Tech.
    Eds.: L. V. Yepifanova and Yu. V. Rylina.

PURPOSE: This book is intended for scientific research workers and
    engineers concerned with problems in the physicochemical mechanics
    of metals.

Card 1/02

S/659/62/008/000/015/028
42023
I048/I248

1.1600

AUTHORS: Gorbunov, N.S., Shatalova, I.G., Likhtman, V.I., and Rebinder, P.A.

TITLE: Investigation of the vibration compacting of powdered metals and their compounds

SOURCE: Akademiya nauk SSSR. Institut metalurgii, Issledovaniya po zharoprochnym splavam. v.8. 1962. 103-110

TEXT: The vibratory compacting of various metal, carbide, nitride, boride, and metal-carbide powders was studied on the I-116 vibrator, at a frequency of 14000 vibrations/min. The vibratory compacting of materials having elastic moduli above 25000 kg./sq.mm. (e.g., Mo, TiC, WC, TiB$_2$, Co+WC) yielded products with a density equal to or higher than that obtained under static loads of 1200 kg./sq.cm.; the pressure applied during the vibratory compacting was 20 kg./sq. cm. In some cases densities higher than the density produced by any other method were obtained through the use of the vibration method,

Card 1/2

S/659/62/008/000/015/028
I048/I248

Investigation of the vibration...

e.g., 9 g./cc in the case of WC+3% Co. However, vibratory compact-
ing was inferior to the conventional static pressure method when
applied to materials with elastic moduli below 25000 kg./sq.mm.
(e.g., Co, Cr). The density of vibration-compacted products in-
creased with time under load and generally reached a constant value
after about 25 secs. In all cases the density increased with in-
creasing pressure. The final density was affected by the nature
and amount of liquid wetting agent used, e.g., a 6% aq. solution of
glycerine gave better results than water alone, the optimum amount
of the glycerine solution being 6.5% by wt. of the powder. The den-
sity increased with increasing kinetic moment of the vibrations
(within the range 0.065-0.35 kg.cm.). There are 5 figures and 3
tables.

Card 2/2

42024
S/669/62/008/000/016/028
I048/I248

15.2250

AUTHORS: Bal'shin, M.Yu., and Likhtman, V.I.

TITLE: Some problems of the theory of heat resistance of
metalloceramic materials

SOURCE: Akademiya nauk SSSR. Institut metallurgii, Issledovaniya
po zharoprochnym splavam. v.8. 1962. 110-116

TEXT: Results from a study of the effect of structure and size of
TiC-Cr_3C_2-graphite and SiC-B_4C-graphite products on their heat re-
sistance are reported. Increasing the diameter of TiC-Cr_3C_2-C
cylinders caused a considerable reduction in their heat resistance,
cracking being observed after 17 heating (to 1200°C) - quenching
(in water) cycles for cylinders 12 mm. in diameter, and after 10
such cycles for cylinders 15 mm. in diameter; the decrease in heat
resistance was accompanied by an increase in electrical resistivity.
Granulation of the powders used in the preparation of these products
(either by cementing with an organic cement of by sintering) caused

Card 1/2

S/137/63/000/003/004/016
A006/A101

AUTHORS: Likhtman, V. I., Smolyanskiy, M. L.

TITLE: Physico-chemical phenomena in pressing and sintering of powder metals

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 3, 1963, 47, abstract 30297 ("Uch. zap. Mosk. gos. zaochn. ped. in-t", 1962, no. 9, 46 - 62)

TEXT: The authors stress the importance of studying the nature of changes in the contact surface of sinters during pressing and sintering, for the purpose of explaining their properties. Brief information is given on the basic regularities in the effect of the surface-active greases upon plastic deformation of the metal. To study changes in the contact surfaces the method of surface activity was employed. It is shown with Cu and Fe powders that in active lubricants (a solution of oleic acid in benzene) active surfaces increase much more rapidly at higher pressure lubricants. An addition of surface-active expansion of the briquets after pressing.

Physico-chemical phenomena in pressing and...

S/137/63/000/003/004/016
A006/A101

Surface-active greases increase the corrosion resistance of metallic powders. Changes in the contact surfaces during sintering were studied on Cu-briquets and take place in 3 stages. At stage no. 1, as a result of relaxation of residual stresses, one portion of the contacts breaks down - electric conductivity decreases. During stage 2 the oxides are reduced and the non-metallic contacts become metallic - electric conductivity sharply increases. The second stage of sintering is simulated on thin Cu films. During stage 3 collective recrystallization inside and between the particles takes place - electric conductivity varies slightly. Burning out of surface-active greases produces high concentration of the reducing agent and promotes a more accelerated reduction of oxides than without surface-active lubricants. There are 18 references.

O. Padalko

[Abstracter's note: Complete translation]

Card 2/2

LIKHTMAN, V.I.

"Principles of powder metallurgy" by I.M. Fedorchenko, R.A. Andrievskii. Reviewed by V.I. Likhtman. Porosh. met. 2 no.3:110-111 My-Je '62.

(Powder metallurgy)   (MIRA 15:7)
(Fedorchenko, I.M.)   (Andrievskii, R.A.)

LIKHTMAN, V.I.; SMOLYANSKIY, M.L.

Physicochemical phenomena in pressure sintering of powdered
metals. Uch. zap. MGZPI no.9:46-62 '62.   (MIRA 16:6)

(Powder metallurgy)

SMOLYANSKIY, M.L.; LIKHTMAN, V.I.

Effect of the medium on the strength of metals. Uch. zap.
MGZPI no.9:90-95 '62.

(MIRA 16:6)

(Strength of materials)

LIKHTMAN, V.I., doktor fiz.-matem.nauk, prof. (Moskva)

Strength of metals and ways to increase it. Fiz. v shkole 22
no.2:4-11 Mr-Ap '62.

(Metals--Hardening)

(MIRA 15:11)

/S,III0

35603

S/020/62/143/001/018/030
B104/B108

AUTHORS: Chayevskiy, M. I., Bryukhanova, L. S., and Likhtman, V. I.

TITLE: Durability of steels in the presence of active metal melts

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 143, no. 1, 1962, 92-94

TEXT: Specimens of steel C_T 50 (St 50) in normal state, with a test length of 30 mm and a diameter of 10 mm were investigated. Part of the specimens were provided with 0.5 mm deep notches (edge angle 45°) as stress concentrator. In the presence of a eutectic Pb-Sn alloy, the logarithm of the time up to rupture of the specimen at a deformation rate of about 10% per minute suddenly drops (Fig. 1). This destruction is not related to thermal activations. Zn-Sn melts with 50% Sn immediately form compounds in the cracks of the steel specimens owing to their high surface activity. Thus, the stress ranges in the specimens are widened very much. The reduction in surface energy owing to adsorption is greater than for Pb-Sn melt. Consequently, the stress at which the logarithm of the time up to destruction suddenly drops, is much smaller for Zn-Sn than for Pb-Sn (Fig. 2). Sn-Cu melts (5% Cu) are even more active. There are 2 figures

Card 1/2

Durability of steels in the ...   S/020/62/143/001/018/030
                                         B104/B108

and 5 references: 4 Soviet and 1 non-Soviet. The reference to the
English-language publication reads as follows: G. W. Austin, J. Inst.
Met., 58, 1 (1936).

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute
              of Physical Chemistry of the Academy of Sciences USSR)

PRESENTED: May 16, 1961, by P. A. Rebinder, Academician

SUBMITTED: May 3, 1961

Fig. 1. Durability of St 50 as a function of stress at 400°C.
Legend: (1) specimens without notch; (2) specimens with notch; (I) spec-
imens without notch in Pb-Sn melt; (II) specimens with notch in Pb-Sn
melt; (τ) time up to rupture; (p) stress.
Fig. 2. Durability of St 50 as a function of stress at 400°C, (specimens
without notch).
Legend: (1) specimens in air; (2) specimens in Zn-Sn melt; (τ) and (p) as
in Fig. 1.
Card 2/3

AUTHORS: Troitskiy, O.A., Likhtman, V.I.

TITLE: Common action of β-radiation and a surface-active medium on the mechanical properties of zinc single crystals

PERIODICAL: Akademiya nauk SSSR, Doklady, v. 147, no. 4, 1962, 874-877

TEXT: Zinc single crystals approximately 1 mm in diameter, coated with a mercury film of ~5μ were exposed to the β-radiation of $Na_2HP^{32}O_4$ (half life of P^{32} : 14.3 days, E_m = 1.7 Mev, total activity : 100 mCu). The behavior of the irradiated specimen on stretching and its plastic deformation were measured. Preliminary experiments with non-amalgamated, irradiated zinc single crystals showed the yield strength to be slightly higher than in non-irradiated specimens. This increase is due to an inhibition of dislocations caused by interstitial atoms and vacancies forming in the lattice by irradiation. Plastic yield, occurred when the specimen was alternately stretched for three minutes and kept under constant stress for another three minutes. The dynamometer showed a

Card 1/3

Common action of β-radiation and a ...

S/020/62/147/004/023/027
B101/B186

270-280 g drop for irradiated Zn, and a 130-150 g drop for non-irradiated Zn. Amalgamated zinc single crystals with an orientation $\chi = 50°$, lost their strength completely after 7 days of irradiation. When stretched during irradiation, their basal surface ruptured at ~20 g/mm², and an elongation of no more than 1-1.5%. Amalgamated, non-irradiated crystals had a yield strength of ~200 g/mm², but also ruptured when elongated but slightly. Irradiation intensified the migration of the surface-active medium along the lattice defects to the surface newly formed by deforma-tion. Amalgamated zinc single crystals with $\chi = 35°$ which, after pre-liminary irradiation of 50 hrs were stretched at a rate 10% per min at 20 or -196°C ruptured after greater elongation than non-irradiated specimens. Selective alloying at the defects, caused by irradiation during an exposure of 50 hrs, was more distinct than after 170-hr amalgamation where the effect of selective alloying was leveled off. This increase in strength and plasticity of amalgamated and irradiated zinc single crystals, observed above all in liquid nitrogen, shows a new way of increasing the strength of metals. It is based on the penetration of a surface-active substance (e.g. an alloy) into the structural defects of the metal at comparatively high temperatures; it solidifies at

Card 2/3

Common action of β-radiation and a ...   S/020/62/147/004/023/027
                                                          B101/B186

lower temperatures and thus blocks these defects.   There are 4 figures.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute
               of Physical Chemistry of the Academy of Sciences USSR)

PRESENTED: July 14, 1962, by P.A. Rebinder, Academician

SUBMITTED: July 12, 1962

Card 3/3

LIKHTMAN, V.I., prof., doktor fiz.-mat. nauk, otv. red.; GOLOVIN,
S.Ya., red. izd-va; UL'YANOVA, O.G., tekhn. red.

[Physicochemical regularities in the action of lubricants
for metalworking by pressure] Fiziko-khimicheskie zakono-
mernosti deistviia smazok pri obrabotke metallov davleniem.
Moskva, Izd-vo AN SSSR, 1963.   175 p.   (MIRA 16:10)

1. Akademiya nauk SSSR. Institut fizicheskoy khimii.
(Metalworking lubricants)

KARPENKO, Georgiy Vladimirovich. Prinimal uchastiye KRIPYAKEVICH, R.I.; LIKHTMAN, V.I., doktor fiz.-matem. nauk, prof., retsenzent; FURER, P.Ya., red.; GORNOSTAYPOL'SKAYA, M.S., tekhn. red.

[Steel resistance in a corrosive medium] Prochnost' stali v korrozionnoĭ srede. Moskva, Mashgiz, 1963. 185 p.

(Steel—Corrosion)   (MIRA 16:7)

ACCESSION NR: AT4014057   ,   8/3072/63/000/000/0005/0030

AUTHOR: Korbut, V. M.; Veyler, S. Ya.; Likhtman, V. I.; Rebinder, P. A.

TITLE: Physicochemistry of the lubricating effect during wire drawing

SOURCE: Fiz.-khim. zakonomernosti deystviya smazok pri obrabotke metallov davleniyem. Moscow, Izd-vo AN SSSR, 1963, 5-30

TOPIC TAGS: metal lubrication, wire drawing lubrication, wire drawing, lubricant

ABSTRACT: The physicochemistry of the lubrication process is a very significant problem in the pressure treatment of metals. This problem was discussed and evaluated on the basis of: (1) effect of the media on the process of metal deformation, (2) mechanism of the lubrication effect on pressure treatment (deformation) of metals, (3) the effect of the temperature during pressure treatment and the physicochemical properties of the lubricant during wire drawing, and (4) the effect of the amount of lubricants used. It was concluded that the stresses of the treatment and the shearing strength in the thin surface layer determine the properties of the lubricant. In some cases, the surface properties of the treated metal are also of significance. Some lubricants react chemically

Card 1/2

ACCESSION NR: AT4014057

with the treated metal. For example, as a result of the process of wire drawing of
aluminum in the presence of liquid-cooling lubricants, water stains or spots are
formed. Dark spots are also formed during wire drawing with dry soap powder or
by lubrication with liquid salt solution at 100C. In the presence of distilled
water, no water stains are formed. It was proved that formation of dark water
stains on aluminum alloys can be prevented by applying lubricants based on a
kerosene emulsion but the stresses due to wire drawing are not reduced by this
lubricant. These lubricants proved highly valuable during rolling of aluminum
but not during the process of wire drawing. The addition of calcium stearate or
aluminum stearate markedly reduced the stress of wire drawing of aluminum alloys.
Positive results in the drawing of aluminum wire have been obtained under
technological conditions by applying a lubricant consisting of kerosene
emulsion with calcium stearate. Orig. art. has: 13 figures and 9 tables.

ASSOCIATION: None

SUBMITTED: 00   DATE ACQ: 19Dec63   ENCL: 00

SUB CODE: MM   NO REF SOV: 077   OTHER: 006

Card 2/2

ACCESSION NR: AT4014058   S/3072/63/000/000/0031/0037

AUTHOR: Veyler, S. Ya.; Petrova, N. V.; Likhtman, V. I.

TITLE: Some physicochemical effects of lubricants and oxides during the thermal processing of stainless steels

SOURCE: Fiz.-khim. zakonomernosti deystviya smazok pri obrabotke metallov davleni-yem. Moscow, Izd-vo AN SSSR, 1963, 31-37

TOPIC TAGS: lubricant, oxide coating, steel processing, wire drawing, stainless steel, steel 1Kh18N9T, heat treatment

ABSTRACT: Some of the physicochemical effects of lubricants on the thermal proces-sing of steel 1Kh18N9T were investigated by determining the temperature dependence of the wire-drawing force in the interval from -70 to +500C. Various lubricants were applied: powders of NaCl, CaCl$_2$ and NaNO$_3$; Al-powder plus liquid glass; eutectics containing 32.55% SnCl$_2$ and 7.45% KCl; Al-powder; film of oil paint; soap solution plus CaSt (calcium stearate); CaCl$_2$ + graphite; tin coating. It was found that a thin film of Sn, developed from the salt eutectic on the surface of the treated metal, showed the highest lubrication properties. The reduction of the

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ACCESSION NR: AT4014058

wire drawing force is due to a decrease in the shear resistance in the thin layer
of the lubricant. The metallic liquid film plasticizes the processed steel surface
and makes it softer. Figure 1 of the Enclosure illustrates the effect of a tin
layer and graphite as lubricants on wire drawing force in relation to temperature.
The presence of the oxide layer inhibits the steel wire drawing process because the
shear resistance in this layer becomes higher. Figure 2 of the Enclosure shows
that the removal of the oxide layer substantially reduces the force required for
wire drawing. Lubrication with graphite reduces the wire drawing forces but at the
same time deteriorates the quality of the steel surface. Orig. art. has: 7 figures
and 2 tables.

ASSOCIATION: None

SUBMITTED: 00

SUB CODE: MM

DATE ACQ: 19Dec63

NO REF SOV: 007

ENCL: 02

OTHER: 001

Card 2/4

ACCESSION NR: AT4014058

ENCLOSURE: 01
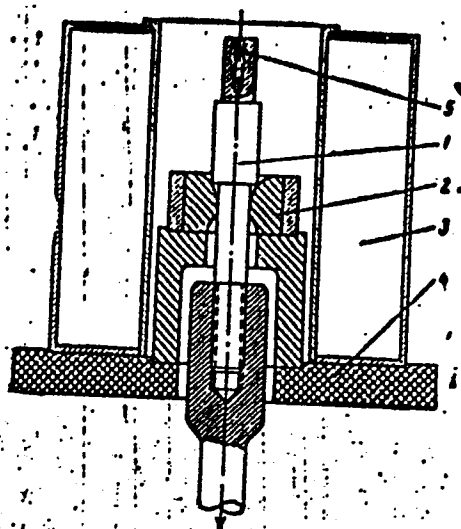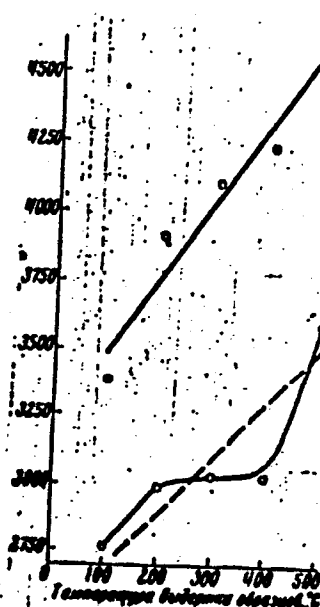

Fig. 1. Relationship between wire-drawing force in kg and temperature in ℃:
1-no lubricant; 2-Sn film; 3-Sn + graphite

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ACCESSION NR: AT4014058

ENCLOSURE: 02

Fig. 2. Relationship between wire-drawing
force at 20°C in kg and temperature of
formation of the oxide film in °C: 1-oxide
film present; 2-oxide film removed.

Card 4/4

ACCESSION NR: AT4014061

S/3072/63/000/000/0066/0069

AUTHOR: Veyler, S. Ya.; Likhtman, V. I.; Petrova, N. V.; Vasil'yeva, Ye. N.; Basova, I. G.; Kuznetsov, K. I.; Livanov, V. A.

TITLE: Effect of cooling and lubricating fluids upon the quality of the sheet surface during rolling of aluminum alloys

SOURCE: Fiz.-khim. zakonomernosti deystviya smazok pri obrabotke metallov davleniyem. Moscow, Izd-vo AN SSSR, 1963, 66-69

TOPIC TAGS: aluminum, aluminum alloy, aluminum sheet, aluminum rolling, sheet rolling, cooling fluid, lubricating fluid, emulsol

ABSTRACT: The normal water-emulsion lubricants used during the rolling of aluminum alloys prove unsatisfactory under technological conditions because they produce water stains on the surface of the rolled metal and become impure after a few days of service. Therefore,

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ACCESSION NR: AT4014061

...in the present work, a new improved type of lubricant has been developed to prevent the formation of surface failures. Also, a procedure for regenerating the emulsion has been worked out. Emulsol, containing 84% kerosene, 10% oleic acid and 6% triethanolamine, was tested and proved satisfactory as a lubricant. Especially good results were obtained with a lubricant emulsion containing 30-40% of the above-mentioned emulsol. Using this lubricant, the surface of the rolled aluminum sheet became smooth, brighter and free of surface defects, and rolling was simplified. This lubricant was also used successfully in the cold extrusion of aluminum tubes as well as in the cutting of aluminum and its alloys. The service life of the emulsion was prolonged up to six months. Desalting with sodium chloride, calcium chloride and karnalit and separating the sedimented emulsion was found to be an effective method for regenerating the emulsion. Orig. art. has: 1 chemical equation.

ASSOCIATION: none

SUBMITTED: 00

SUB CODE: MM

DATE ACQ: 19Dec63

NO REF SOV: 002

ENCL: 00

OTHER: 005

Card 2/2

ACCESSION NR: AT4013968   S/2659/63/010/000/0295/0300

AUTHOR: Gorbunov, N. S.; Shatalova, I. G.; Likhtman, V. I.

TITLE: The influence of several factors on the density of packing of powder particles under the influence of vibration

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya po zharoprochny*m splavam, no. 10, 1963, 295-300

TOPIC TAGS: powder metallurgy, powder metal density, packing density, vibrations, magnetic material, chemical stability

ABSTRACT: One of the most important technological operations in powder metallurgy is the pressing of powder into parts. It is very difficult, however, to obtain high density pressed parts from hard and brittle powder materials. The present investigation on the density of packing of powder particles under vibration was based on the theories of Academician P. A. Rebinder. The investigation showed that parts with a density up to 90% may be obtained when powders are vibrated. The following conditions must be ob- served: Two or three fractions of powder of optimal size should be used. The powder particles should be able to be compacted and should be of relatively simple shape. There should be no significant roughness on the particle boundaries. The duration of vibration should be limited by the time required for final placing of the particles, especially for

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ACCESSION NR: AT4013968

particles of brittle, non-plastic materials. Table 1 of the Enclosure shows the change in powder density with the course of time of vibration. Orig. art. has: 1 figure and 4 tables.

ASSOCIATION: Institut metallurgii AN SSSR (Institute of Metallurgy AN SSSR)

SUBMITTED: 00

SUB CODE: MM

DATE ACQ: 27Feb64

NO REF SOV: 002

ENCL: 01

OTHER: 000

Card   2/3

ACCESSION NR: AT4013968

TABLE 1

ENCLOSURE: 01

The change in packing density of powders with the course of time of vibration

Material of the powder	frequency, vibr./min	amplitude, microns	specific pressure kg/cm²	3	6	9	12	15	18	21	24	30
									Density (at equal length of vibration in sec.), g/cm³			
Chromium	14 000	20	18.2	4.14	4.29	--	4.36	--	4.40	--	4.46	4.46
	10 000	65	18.2	4.43	4.56	--	4.67	--	4.72	--	4.72	--
Molybdenum boride	14 000	14	18.2	2.44	2.62	2.67	--	2.71	--	2.76	--	2.78
	10 000	75	17.6	3.12	3.30	--	3.38	--	3.52	--	3.52	--
Carborundum	14 000	15	21.2	2.02	2.06	2.09	2.12	2.12	--	--	--	--
	10 000	90	24.3	2.22	2.27	--	2.27	--	--	--	--	--

Card   3/3

L 14304-63   EWP(q)/EWT(m)/BDS   AFFTC/ASD   JD
                                              8/0126/63/015/004/0534/0537
ACCESSION NR: AP3000096

AUTHORS: Troitskiy, O. A.; Olasunov, P. Ya.; Likhtman, V. I.

TITLE: Effect of preliminary electron irradiation upon the strength of zinc coated with fusible eutectics

SOURCE: Fizika metallov i metallovedeniye, v. 15, no. 4, 1963, 534-537

TOPIC TAGS: electron irradiation, zinc, eutectic, Zn-Sn, Zn-Cd, Zn-Pb

ABSTRACT: The adsorption effect of fusible metallic coatings on the mechanical properties of relatively harder-to-fuse metals has been studied. The experiment involved an electron irradiation of polycrystalline zinc samples coated with fusible eutectics: Zn-Sn (85 atomic % Sn), Zn-Cd (73.2 atomic % Cd), and Zn-Pb (97 atomic % Pb). The electron energy used was 1-1.2 Mev. The electron doses obtained from a linear accelerator varied from 10^{16} to 3.7×10^{17} electrons/cm^2. The irradiation doses were determined by the intensity of the electron flux, the irradiation area at a given distance from the accelerator window, and by the irradiation time interval. The relation between the relative hardening and the irradiation time at temperatures of 20C and 200-220C was determined, as was the relation between the relative hardening and temperature. The authors conclude that the irradiation of

Card 1/2

L 14304-63
ACCESSION NR: AP3000096

the polycrystalline zinc samples covered by hard eutectic alloys at 20C results in
a maximum hardening of 15%. The electron irradiation activates the process of
melted coating penetration into the voids of the crystalline lattice, thus causing
hardening up to 40%. The greatest irradiation effect is observed in the Zn-Sn
coated samples, because this eutectic has a greater surface activity than Zn-Cd and
Zn-Pb coatings. Orig. art. has: 3 figures.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR (Institute of Physical Chemistry,
Academy of Sciences, SSSR)

SUBMITTED: 14May62   DATE ACQ: 12Jun63   ENCL: 00

SUB CODE: ML, PH   NO REF SOV: 009   OTHER: 000

Card 2/2

L 14296-63   EWP(q)/EWT(m)/BDS   AFFTC/ASD   JD/JG
ACCESSION NR: AP3000110   S/0126/63/015/004/0628/0631

AUTHOR: Troitskiy, O. A.; Kuleshov, I. M.; Likhtman, V. I.

TITLE: Influence of electron- and alpha-radiation on microhardness of zinc and
cadmium in the presence of tin

SOURCE: Fizika metallov i metallovedeniye, vol. 15, no. 4, 1963, 628-631

TOPIC TAGS: Zn microhardness, Cd microhardness, radiation effect, Zn, Cd, Sn,
Zn-Sn, Cd-Sn

ABSTRACT: Samples of pure Zn and Cd and their alloys with tin were exposed to an
electron flux with the energy 1 Mev and to alpha-radiation. Their microhardness
was subsequently measured with the PMT-3 device. The samples were cut from Zn and
Cd foil 0.2 mm thick and electrolytically coated with a tin layer 3 microns thick.
The effect of the neutron and alpha-radiation on the microhardness of the metal
covered by a solid coating, and the effect on the surface activity of a liquid
coating have been studied. The authors concluded that Zn-Sn samples showed a larg-
er increase in microhardness (40%) than Cd-Sn (17%). The largest microhardness
increase was obtained by the alpha-particle bombardment of the Zn-Sn samples. The
thickness of the hardened zone corresponds to the depth of alpha-particle penetra-
tion. The irradiation also increased the surface activity of a liquid coating.

Card 1/1   Association: Inst. of Physical Chemistry

L 18653-63   EWT(1)/EWP(q)/EWT(m)/BDS   AFFTC/ASD   JD/JG/WB
ACCESSION NR: AP3004589   8/0126/63/016/001/0044/0050

AUTHOR: Troitskiy, O. A.; Kuleshov, I. M.; Likhtman, V. I.

TITLE: Combined effect of radioactive radiation and mercury on mechanical
properties of zinc single crystals

SOURCE: Fizika metallov i metallovedeniye, v. 16, no. 1, 1963, 44-50

TOPIC TAGS: zinc single crystal, mercury-treated crystal, crystal tensile
strength, crystal ductility, electron-bombardment effect, α-particle-bombardment
effect, β-particle-bombardment effect, γ-ray-irradiation effect, combined
mercury-treatment-irradiation effect, stress relaxation

ABSTRACT: Tension tests have been conducted on mercury-coated specimens of zinc
single crystals 10 mm long and 1 mm in diameter, bombarded with α- and β-parti-
cles or γ-rays from Pu^{239}, P^{32}, and Co^{60}, and uncoated specimens bombarded with
electrons, β-particles, or γ-rays. After bombardment for 3—5 min the uncoated
specimens were stretched, with a three-minute rest under load after the first
minute and after each subsequent three-minute loading. The test results showed
that electron, β-, or γ-irradiation increases the tensile strength and ductility

Card 1/3

L 18653-63
ACCESSION NR: AP3004589   2

by intensifying the stress relaxation and increasing the plastification of zinc
single crystals. The latter process appears to be associated with the appear-
ance and annihilation of radiation defects rather than with the migration of
crystal defects. The ordinary dislocation plastic flow appears to be supple-
mented by diffusion flow during the final rest periods. Additional vacancy-
atom Frenkel pairs introduced by irradiation facilitate the process. The
stretching at 20 and -196C of mercury-treated specimens previously bombarded
by α- or β-particles for up to 1550 hr or irradiated by γ-rays for up to
1450 hr showed that short-time irradiation increased the ductility and, to a
lesser extent, the tensile strength, particularly at -196C. The maximum increase
in tensile strength was 35% at -196C, after an exposure of 16—18 hr. After
exposure for longer than 1000 hr, the tensile strength dropped by 50% at sub-
zero temperatures and by 75—80% at 20C. Elongation of the specimens followed
a similar pattern: a 300% increase in ductility occurred after exposure for
25—26 hr; after further exposure, gradual embrittlement occurred. Strengthen-
ing after comparatively short exposure to radiation is associated with the in-
duction of radiation defects and intensification of the diffusion penetration
of mercury into zinc (alloying). The sharp weakening of the crystals after
exposure for over 1000 hr is the result of coagulation of radiation defects

Card 2/3

L 18653-63
ACCESSION NR: AP3004589   /

and formation of new internal interfaces. Migration of mercury to these in-
terfaces sharply lowers the free surface energy, and consequently the strength
and ductility. Orig. art. has: 6 figures.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR (Institute of Physical
Chemistry, AN SSSR)

SUBMITTED: 28Dec62   DATE ACQ: 27Aug63   ENCL: 00

SUB CODE: MA   NO REF SOV: 007   OTHER: 002

Card 3/3

LIKHTMAN, V.I.; TROITSKIY, O.A.

Combined effect of irradiation and of a surface-active medium
on the mechanical properties of single metal crystals. Zhur.
fiz.khim. 37 no.8:1893-1896 Ag '63.   (MIRA 16:9)
     (Metal crystals) (Radiation) (Surface-active agents)

ACCESSION NR: AT4014066   S/3072/63/000/000/0115/0120

AUTHOR: Gurovich, Ya. I.; Veyler, S. Ya.; Likhtman, V. I.; Voskresenskaya, N. K.

TITLE: Investigation of the lubricating properties of salt mixtures during the pressure heat treatment of metals

SOURCE: Fiz.-khim. zakonomernosti deystviya smazok pri obrabotke metallov davleniyem. Moscow, Izd-vo AN SSSR, 1963, 115-120

TOPIC TAGS: salt mixture, lubricant, lubricating property, heat treatment, metal, metal alloy, salt eutectic, corrosion, wire drawing

ABSTRACT: Since the usual lubricants such as graphite, liquid glass, or mineral oils prove unsatisfactory during hot pressure working of stainless steels, some new lubricants such as salt mixtures have been investigated.. The following salt mixtures have been tested: (1) Nitrate-nitrite salts, applied during punching of aluminum alloys. These have proved dangerous because of their explosive properties; (2) Salts such as $MgCl_2$, KCl, $NaCl$, $ZnCl_2$ and K_2SO_4; (3) Melts containing $ZnCl_2$ and ZnS; (4) Melts such as $PbCl_2$; (5) Mixtures containing salts of Sn; (6) Melts such as Cd-salts, Li-salts, and salt mixtures such as phosphates. Two groups of eutectic mixtures may be distinguished: (a) Salt mixtures forming

Card 1/3

ACCESSION NR: AT4014066

versus temperature with eutectic $ZnCl_2$-KCl applied as a lubricant showed a minimum close to 200C whereas the eutectic temperature appeared lowest near 230C.
Orig. art. has: 1 figure and 3 tables.

ASSOCIATION: None

SUBMITTED: 00   DATE ACQ: 19Dec63   ENCL: 00

SUB CODE: MM   NO REF SOV: 006   OTHER: 006

Card 3/3

S/020/63/148/002/024/037
B108/B186

AUTHORS: Troitskiy, O. A., Likhtman, V. I.

TITLE: The anisotropic action of electron and gamma radiation
                on the deformation of zinc single crystals in brittle state

TEXT: A mercury layer can reduce the strength and ductility of zinc
single crystals considerably. This effect is further intensified when
a mercury covered zinc sample is exposed to gamma or beta radiation.
Tensile tests with amalgamated Zn irradiated during the process of
deformation showed that the orientation of the crystal base plane toward
the source of radiation is of essential significance. The crystal became
more brittle when the base plane was perpendicular to the direction of
irradiation, and it became more ductile when the base plane was parallel
to the direction of irradiation. This effect, though weaker, was also
observed on samples without a surface-active medium. There are 4 figures.

Card 1/2   Inst. Phys. Chem AS USSR

L 16988-63   EPF(c)/EWP(q)/EWT(m)/BDS   AFFTC/ASD   Pr-4   JD
                                   S/020/63/149/005/012/018

AUTHOR: Troitskiy, O. A. and Likhtman, V. I.   65

TITLE: The combined effect of mercury and radioactive radiation on the
            mechanical properties of single crystals of zinc

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 149, no. 5, 1963, 1115-1118

TEXT: The authors investigate the of more or less prolonged irradiation
of amalgamated single crystals of zinc with β-, α-, and γ - emitters of the
laboratory type. The zinc crystals, 10 mm long and ~1 mm in diameter, were grown
by the zone melting method, and coated with mercury by the contact deposition
method. After irradiation, the crystals were subjected to the presence of
tests of compressive strength and plasticity at -196°C and +20°C, which revealed
a decrease in the strength and plasticity of the specimens. There are 3 figures.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of
                Physical Chemistry, Academy of Sciences USSR)

SUBMITTED: December 3, 1962

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L 61030-65   EWP(e)/EWT(m)/EPF(n)-2/EWP(t)/EWP(k)/EWP(z)/EWP(b)   Pf-4/Pu-4   IJP(c)
ACCESSION NR: AR5017418   JD/JG   UR/0137/65/000/006/G028/G028

SOURCE: Ref. zh. Metallurgiya, Abs. 6G194

AUTHOR: Shatalova, K. G.; Gorbunov, N. S.; Likhtman, V. I.

TITLE: Investigation of density distribution over the height of briquets during vibration compacting of powders
CITED SOURCE: Tr. 7 Vses. nauchno-tekhn. konferentsii po poroshk. metallurgii. Yerevan, 1964, 101-105

TOPIC TAGS: powder metal compaction, vibration, tungsten, cobalt, specific density
TRANSLATION: An investigation was made of density distribution over the height of briquets, after vibration compacting at a frequency of 260 cycles; the powder was a mixture of tungsten powders containing 20% cobalt, wetted with a solution of glycerin in alcohol (0.3 glycerin). The diameter of the briquets was 20 mm, and the height from 7.75 to 106.80 mm. The compacting pressure in all cases was 25 kg/mm², The vibrations were intensively damped in the layer of the briquets

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L 61030-65

ACCESSION NR: AR5017418 O

at a distance of 10-20 mm from the source of the vibrations. Application of the principle of a floating die decreases the nonuniformity of the density. Forced vibration of the die made it possible to reduce the nonuniformity of the density distribution in high briquets. Vibration compacting permitted production of briquets with a higher ratio of height to diameter and with a better density distribution than by static pressing. M. Bal'shin

SUB CODE: MM   ENCL: 00

Card 2/2 ЛЛР

SHATALOVA, Irina Georgiyevna, kand. tekhn. nauk; GORBUNOV,
    Nikolay Stepanovich, prof., doktor khim. nauk; LIKHTMAN,
    Vladimir Iosifovich, prof. doktor fiz.-matem. nauk;
    REBINDER, P.A., akademik, otv. red.; CHERNYAK, A.L., red.

[Physicochemical principles of the vibrational compression
of powdered materials] Fiziko-khimicheskie osnovy vibratsion-
nogo uplotneniia poroshkovykh materialov. Moskva, Nauka,
1965. 162 p.   (MIRA 18:3)

1. Rukovoditel' Instituta fizicheskoy khimii AN SSSR (for
Rebinder).

L 1652-66   EWT(m)/EPF(c)/T/EWP(t)/EWP(k)/EWP(b)/EWA(c)   LJP(c)   BW/JD/HW/DJ

ACCESSION NR: AP5021583   UR/0286/65/000/013/0055/0055
                                                 665.5

AUTHOR: Veyler, S. Ya.; Petrova, N. V.; Zalivalov, F. P.; Likhtman, V. I.;
Tomashov, N. D.

TITLE: Method for applying lubricating film.   Class 23, No. 172445

SOURCE: Byulleten' izobreteniy i tovarnykh znakov, no. 13, 1965, 55

TOPIC TAGS: lubrication, film lubrication, solid lubricant

ABSTRACT: This Author Certificate introduces a method for hot working aluminum and
its alloys in which the anodized layer serves as the lubricant.   [AZ]

ASSOCIATION: none

SUBMITTED: 16Jul62   ENCL: 00   SUB CODE: IE,MM

NO. REF SOV: 000   OTHER: 000   ATD PRESS: 4093

Card 1/1 DP

L 00317-66   EWP(e)/EWT(m)/EWP(w)/EPF(c)/EWP(i)/EWA(d)/T/EWP(t)/EWP(z)/
EWP(b)/ETC(m)   MJW/BW/JD/WW/DJ/GS/WH

ACCESSION NR: AT5020434   UR/0000/65/000/000/0085/0088

AUTHORS: Dymkovskiy, N. V.; Likhtman, V. I.

TITLE: Friction and wear of graphite materials during operation in fluid contact face seals

SOURCE: AN SSSR. Nauchnyy sovet po treniyu i smazkam. Teoriya smazochnogo deystviya i novyye materialy (Theory of lubricating action and new materials). Moscow, Izd-vo Nauka, 1965, 85-88

TOPIC TAGS: lubricant, graphite, lubricant seal, wear seal

ABSTRACT: The friction and wear of graphite (compressive strength 1700 kg/cm^2, elastic modulus 1200 kg/mm^2, impact strength 3.5 kg cm, 17% porosity) rings with 12- and 18-mm wide contact surfaces rubbing against steel (2Kh13) rings with smooth surfaces and surfaces having 12, 36, and 60 radial grooves (6 mm wide, 0.4-0.7 mm deep) were investigated at a speed of 6.5 m/sec and maximum contact pressure of 19.5-25 kg/cm^2 (in water). Before testing, the rings were worn in by gradual increase of load, and then the wear and the friction torque were measured at maximum load for up to 50 hours of operation. It was found that the

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L-00317-66

ACCESSION NR: AT5020434   5

formation of transverse cracks in the steel rings and accompanying high graphite
wear could be decreased by using soft steel (HRC16-20) and that the friction
torque would decrease by a factor of 2-3 in that case. Tests with 12-mm wide
graphite rings and radially grooved steel rings showed decreased cracking but
resulted in high graphite wear, as it was found that only 30-50% of the graphite
surface was in good contact. Increasing the contact width to 18 mm showed that
this procedure, combined with the grooved rings, provided low friction torque,
minimum friction cracks, and acceptably low graphite wear (0.2-1.5 micron/hr
after run-in). The contact surfaces were found to be worn mirror-smooth, indica-
ting that a water film was supporting the load. Orig. art. has: 1 table.

ASSOCIATION: Nauchnyy sovet po treniyu i smazkam, AN SSSR (Scientific Committee
on Friction and Lubrication, AN SSSR)

SUBMITTED: 22May65   ENCL: 00   SUB CODE: FP,MT

NO REF SOV: 008   OTHER: 000

Card 2/2

REBINDER, P.A., akademik; LIKHTMAN, V.I., prof., doktor fiz.-matem. nauk

Reviews and bibliographies. Fiz.-khim. mekh. mat. 1 no.1:
114-115 '65.   (MIRA 19:1)

L 62534-65   /EPF(c)/EWT(m)/EWP(i)/EWP(b)/EWA(d)/EWP(t)   IJP(c)   JD/JG/WB

ACCESSION NR: AP5012648   UR/0369/65/001/002/0134/0138 33
                                                                                    29
                                                                                     B
AUTHOR: Bryukhanova, L. S.; Andreyeva, I. A.; Likhtman, V. I.

TITLE: Reduction in surface tension of solid metals when atoms from melts of surface-active metals are absorbed on their surfaces

SOURCE: Fiziko-khimicheskaya mekhanika materialov, v. 1, no. 2, 1965, 134-138

TOPIC TAGS: surface tension, zinc, thin film, surface active agent

ABSTRACT: The surface tension of solid zinc was measured during adsorption of various quantities of gallium. The surface tension of zinc covered with a thin lead film (2 μ thick) was also measured. The "zero" creep method developed by Tamman and Udin was used (G. Tamman, W. Boehme, *Ann. Phys.*, 1932, 12, 820; H. Udin. A. Shaler, I. Vulff, *Journ. of Metals*, 1949, 1, 186). The method is based on the fact that the specimen expands at temperatures close to the melting point when it is loaded above a certain limiting value P_0, while contraction due to surface tension is observed at loads below P_0. Thus the zero creep load P_0 exactly balances the surface tension. Thus for foil we have the condition $P_0 = a\sigma$ where a is the width of the foil and σ is surface tension. The results of a preliminary study of creep for zinc foil coated

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